

ings, or being blown from their foothold; but one was so terrified that he committed suicide. About 50 other persons were badly injured and two were struck by lightning. The damages amount to a total estimated loss of \$1,000,000, of which \$500,000 was principally sustained by a few large manufacturing establishments, twelve churches and seventeen schoolhouses, nearly all of which were located in the southeast or the southwest sections of the city. The railway and telephone lines operating in these sections were also heavy losers by injuries to their property. The northeast and northwest sections of the city suffered only small losses through damage to property, but even in these sections some roofs of buildings were injured and windows broken, and at A, fig. 1, "every telephone and trolley post on the west side of the street for 8 blocks was either blown down or badly damaged."

Reports received by the local newspapers showed that on the day of this storm considerable damage was done by thunderstorms in the adjacent county (Lorraine) on the west and at places in the belt of counties extending thence northeast to Ashtabula County. At Elyria, according to a report, "Windows were blown in and outbuildings and sheds wrecked." At Medina, "Trees in the public square were uprooted, telegraph poles were blown down and roofs and chimneys wrecked." At Ashtabula, "One house was turned completely upside down and demolished. The roof of the Lyceum Theater was carried over residences and shot through North Park, trees being stripped in its path;" also, "A house was blown from its foundation, barns and small buildings all over the city were unroofed and completely razed." In Plymouth, Ashtabula County, "A man who sought shelter in a horse shed during a thunderstorm was killed by the collapse of a church near by, and another man who had sought shelter in the same shed was knocked senseless, and one of his arms was broken."

It seems probable that if the hours of occurrence of these disturbances, and others on the same day in northern Ohio, could be learned the facts might show that the Cleveland storm originated in one of the counties of northwestern Ohio and traveled thence through this city into Ashtabula County. However, it would probably be impossible to trace the connection between these local storms, owing to the lack of reliable observations of time, barometric readings, and other essential data.

It is believed that the Cleveland storm should properly be classed as an exceptionally severe local storm, but not as a tornado. So far as can be learned, no one saw the funnel-shaped tornado cloud when this storm was advancing or after it had passed. There were but few flashes of lightning. Objects, such as trees or poles that had been overturned by the wind, were found to lie in a direction from southwest to northeast, or west to east, and in the majority of cases they lay toward the east. In a few instances heavy roofing of tin or other material had been carried from one roof to another 100 to 200 feet distant, and they were carried from west to east. In the grove near the Euclid Club, where about 100 trees, large and small, were found uprooted and blown over within an area not larger than four acres, the trunks lay as if overturned by a southwest or west wind. Near the same club house an iron flagstaff, 4 inches in diameter, had been blown nearly prostrate in a northeastward direction, the wind having bent the iron near the base of the staff. Among all the hundreds of houses where panes of window glass were broken out, there seems to have been no breaking by outward expansion of the air, though there were windows fronting east that had their glass broken and forced outward, this effect being probably due to the west squall having reached them through open doors or windows in the rear of the house. So far as can be learned no chickens were stripped of their feathers, nor were any trees stripped of their bark. For these

reasons, and notwithstanding the great destructive force that the wind attained at many places within a zone of 1 to 2 miles in width and 6 miles long within the city and its outskirts, it seems proper to assume that the storm was not a tornado.

#### TORNADO IN ALABAMA.

By E. C. HORTON, Assistant Observer. Dated: Montgomery, Ala., May 21, 1909.

I have the honor to submit the following report of a tornado that occurred in the northern part of Alabama near midday of April 30, 1909.

The storm began about 7 miles southeast of Moulton, Lawrence County, and moved in a northeasterly direction to about  $1\frac{1}{2}$  miles north of Danville, Morgan County, where it seems to have disappeared.

The storm track varied from 100 yards to a half mile in width. The tornado was well defined, having the characteristic funnel-shaped cloud, with the usual destructive effects. At Madison it seems to have been represented by a severe hailstorm. Only one person was killed, but about eighteen were more or less injured. Seven dwellings were demolished, their value being estimated at \$4,000. The damage to timber and other property was also great, and the loss in livestock was considerable. It would probably be conservative to place the entire property loss at not less than \$15,000.

#### TORNADOES IN ARKANSAS.

[Extract from the Monthly Climatological Summary, Arkansas Section, March, 1909.]

*February, 1909.*

At 8 a. m., seventy-fifth meridian time, February 5, 1909, a low of large geographic extent and great intensity extended from the Lake region to Texas, the center of the storm being over Davenport, Iowa, with a pressure of 29.24 inches. At that hour Arkansas was in the southeast quadrant of the storm and the weather, which was abnormally warm, damp, and blustery, with thunderstorms at many places, was favorable for the development of tornadoes.

Between 8 and 9:30 o'clock in the morning tornadoes passed over Hamburg, Ashley County, and Stuttgart, Arkansas County. At Hamburg there was no loss of life and no one was injured, but two brick buildings were damaged, the loss in buildings and merchandise being estimated at \$6,000. The tornado that passed over Stuttgart killed two persons and injured several others, and two residences and six barns were destroyed. At Little Rock, Pulaski County, a thunderstorm, accompanied by rain, hail, and high wind, prevailed from 7:02 to 9:30 a. m., a maximum velocity of 52 miles per hour from the northwest being recorded at 7:12 a. m. No damage resulted in the city from this storm.

During the early morning of February 23, 1909, a destructive tornado passed over portions of Lonoke, Prairie, Woodruff, Jackson, and Poinsett counties. The weather map of February 22 showed a storm of great intensity central over Colorado, while a secondary disturbance overlaid southwestern Texas. These storms, following their usual paths, had moved during the next 24 hours to western Missouri and central Arkansas, respectively.

In Arkansas the weather was cloudy, the temperature much above the normal, and the barometer falling rapidly. The conditions were generally favorable for the development of tornadoes. The storm appeared at Little Rock about 11:30 p. m. of the 22d in the form of a heavy thunderstorm, although the wind was comparatively light. Moving northeastward, it first assumed the proportions of a tornado at McCreanor, Lonoke County, about 2 a. m. of the 23d, where the damage was about \$500 in property and 1 person was injured. About 8 miles southeast of Hickory Plains, Prairie County, the storm caused a loss of \$5,000, killed 1 person, and injured 20. The storm passed southeast of Augusta, Woodruff County, about 3

a. m., killing 5 persons and injuring probably 30. The damage to property was estimated at \$30,000. Continuing northeastward, the storm seemed to increase in severity in the vicinity of McCrory, Woodruff County, where trees were uprooted and houses blown down and scattered in various directions. In one neighborhood, 5 miles north of McCrory, 23 houses were destroyed and others badly damaged. Twenty-three persons were injured, but no lives were lost. About 5 miles southeast of Eight-mile, in the southeastern part of Jackson County, there was a loss of about \$3,000 on property. No one was killed in that vicinity, but 3 persons were injured. Farther northeast the destruction was very great, the little town of Fisher, in the southwestern part of Poinsett County, being almost entirely destroyed. Three people were killed at Fisher and about 28 injured, while the loss on buildings, live stock, and farm implements was estimated at \$40,000. Northeast of Fisher, in the vicinity of Waldenburg, Poinsett County, 1 building was destroyed and a number of others damaged. The entire loss was estimated at \$4,800. Two persons were reported injured, but no one was killed.

The rainfall was heavy throughout the entire section of country traversed by the storm, and the electrical display was very brilliant. A number of buildings were struck by lightning, but the loss by fire was not great on account of the heavy rain which attended the storm.

The path of the storm varied greatly in width in different portions of its course. At some places it was about 60 yards wide, while in other localities it was estimated to be nearly a mile in width. Reports indicate that the greatest damage occurred in Poinsett and Woodruff counties, and it is thought by some to have been the most destructive storm that ever visited Woodruff County.—H. F. A. and T. R. T.

[Extract from the Monthly Climatological Report, Arkansas Section, April, 1909.]  
March, 1909.

On the afternoon and evening of March 8, 1909, tornadoes occurred over an area about 125 miles long by 10 to 60 miles wide, including parts of Ouachita, Cleveland, Dallas, Hot Spring, Grant, Saline, Jefferson, Pulaski, Lonoke, Prairie, and Hot Spring counties between 5 and 5:10 p. m., and the latest, which proved to be the most destructive, at Brinkley, Monroe County, about 7:10 p. m. These storms killed 64 persons, injured 671 others, and caused a property destruction aggregating about \$635,000.

The low within which the tornadoes developed was central near Del Rio, Tex., at 7 a. m., Central time, with a pressure of 29.44 inches, and extended northeastward to the lower Mississippi Valley. During the following 24 hours it moved in a northeasterly direction across Texas, Louisiana, Arkansas, and Missouri (the storm center passing west of Little Rock, Ark., about 5:30 p. m. of the 8th—pressure 29.39 inches), and reached northeastern Missouri by 7 a. m. of the 9th.

The morning of the 8th was cloudy, damp, and abnormally warm in Arkansas, with south to east winds and a low and rapidly falling barometer. At Little Rock, in the center of the State, the temperature was 54° (12 degrees above normal), humidity 94 per cent, and reduced pressure, 29.70 inches. At 7 p. m. the temperature was 66° (14 degrees above normal), humidity 89 per cent, and pressure 29.42 inches. Heavy rains fell over the greater part of the State during the 24 hours ending with 7 a. m. of the 9th. The low was followed by a cool wave. At 7 a. m. of the 9th it was snowing at Bentonville, Ark., and the temperature had dropped to 34°, a fall of 20 degrees in 24 hours.

Most of the tornado reports received indicate that the direction was from southwest to northeast [See fig. 1] and that the path of great destruction varied from 100 yards to one-half mile in width. The pendant, funnel-shaped cloud which char-

acterizes tornadoes was observed in many places. Pine Bluff, Ark., experienced a heavy hailstorm on the 8th, but no destructive winds.

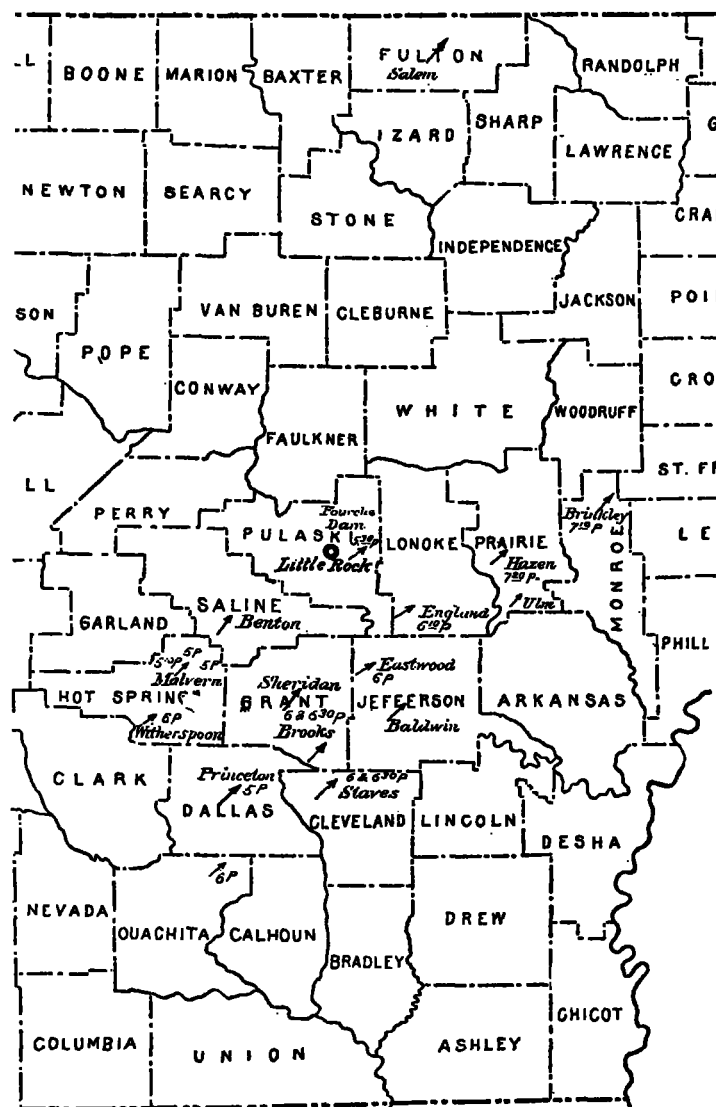


FIG. 1.—Tornadoes in Arkansas, March 8, 1909.

The names of the towns and counties visited by the tornadoes, together with the number of people killed or injured and the approximate value of the property destroyed, so far as known, are given in Table 1, and the localities are shown in fig. 1.

TABLE 1.—Losses and casualties by tornadoes in Arkansas, March 8, 1909.

Place.	County.	Injured.	Killed.	Damage.
Staves.	Cleveland.	8		\$6,000 to \$8,000
Brooks.	Grant.		1	
Sheridan.	Grant.		1	
Salem.	Fulton.		1	
Princeton.	Dallas.	5		2,000
Eastwood (near).	Jefferson.	8	1	1,500
Piney Woods.	Jefferson.		1	
Baldwin's Switch.	Jefferson.		1	
Ferdia.	Jefferson.		1	
Witherspoon.	Hot Spring.	2		2,000
Malvern.	Hot Spring.			9,750
Gifford.	Hot Spring.			5,000
Perla.	Hot Spring.	1		1,000
Fourche Dam (Little Rock).	Pulaski.	1	5	900
Galloway.	Pulaski.	2		
Brinkley.	Monroe.	600	49	600,000
Benton (near).	Saline.	3	1	
Hazen.	Prairie.	20	4	5,000

\* Died of fright.

The following extracts from reports of cooperative observers are interesting:

Princeton: The storm cloud looked like a ball of black smoke.

Staves: There were two storm clouds, one at 6 p. m. and another about thirty minutes later, both moving in the same direction. The first did the greater damage.

England, Lonoke County: I watched the clouds for about an hour before the storm reached England, as I had read the Weather Bureau map at 5 p. m., and was expecting a severe storm. I did not see any funnel-shaped cloud, but that may have been due to the fact that the clouds were low and it was rather dark. About ten minutes before the storm there was much lightning in the west, southwest, and south, and the clouds were going north. At about the same time the clouds changed to northeast, and ten minutes later had passed away. The high wind did not last more than two or three minutes. While the wind was blowing the roar was like that made by many freight cars going at a great speed. Large trees were uprooted and carried a great distance away, the trees in the storm's path having been twisted off about 10 or 15 feet above the ground.—Dr. J. C. Chenault.

Brinkley: The tornado struck this place about 7:10 p. m., central time, and crossed the city from southwest to northeast. It was preceded by vivid lightning and a hard rain, and did not last more than five minutes. The path of greatest destruction extended from a point about 5 miles southwest to a point about 10 miles northeast of the town. About 260 residences and 600 other buildings were totally destroyed, and 750 dwellings and 1,200 other buildings were partially destroyed. The total losses amounted to \$600,000, of which five-sixths were in buildings. Many buildings rocked perceptibly before crashing to the ground. The destruction of the electric-lighting plant threw the city into darkness. Fires started at many points, and only the heavy downpour of rain that followed prevented a general conflagration. In several instances all the members of a family were killed. A number of cars were blown from the tracks of the Rock Island Railroad at Brinkley and Kerr.

April, 1909.

Tornadoes occurred in Monroe and Woodruff counties on the 6th. One person was injured, and the losses in buildings and merchandise were about \$5,000.

On the 29th tornadoes occurred in nine northern and three southern counties, killing 17 people, injuring 76 others, and causing property destruction aggregating about \$100,000.—H. F. Alciatore.

### RED SNOW IN MICHIGAN.

By A. WIESNER. Dated: Houghton, Mich., April 13, 1909.

Late Saturday night or early Sunday morning Calumet was visited by a peculiar storm in that from the air fell a reddish brown sand, mixed with snow, the storm lasting probably the greater part of a half hour. The wind as near as could be judged because of its irregular velocity and variations came from an easterly to southeasterly direction. The sand was fine and light. It has been learned that this sand fell Saturday night and Sunday morning all over the upper peninsula. As far as can be learned no one has advanced an explanation of the phenomenon.

Explorers in the Arctic regions have told of falls of "red" snow similar to that which visited Calumet Saturday night. Often at sea ships are covered with a like substance, which falls from the heavens, although the ship be many miles from land. It is supposed the high wind carried the sand a great distance from some point where the earth was bare of snow and was dry.

With reference to the above extract from the Mining Gazette of Houghton, Mich., for April 13, 1909, I would add that this phenomenon was particularly noticeable at Lake Linden and Calumet, 10 to 12 miles north of Houghton. Fine traces of this dust, resembling powdered brick or hematite dust, were also noticeable in Houghton on the station psychrometer and on the upper surface of the thermograph. The wind during the night of this occurrence, April 10–11, 1909, was brisk east to southeast, the weather was damp, and most of the ground in this locality was still covered with snow. It is evident, therefore, that the dust was not of local origin.

<sup>1</sup>The "red snow" of the polar regions usually owes its color to the rapid increase of a microscopic red fungus-like plant, and rarely to a mineral coloring matter, as in the present case. See Monthly Weather Review, 1901, 29; 465, and elsewhere.—C. A., jr.

### THE AURORA OF MAY 15–16, 1909.

The captain of the Hamburg-American steamer *Pallanza* sends the following very interesting report to the Marine Division of the Weather Bureau.

[TRANSLATION.]

NEW YORK, N. Y., May 17, 1909.

To the DEUTSCHE SEEWARTE,

HAMBURG, GERMANY.

On the night of May 14–15, 1909, as the steamship *Pallanza*, en route to New York, was in longitude 62° to 64° west, a bright aurora was observed.

The next night, May 15–16, as we were nearing the Nantucket Shoals lightship another and very singular display was observed. The night was calm and very clear, the stars visible almost to the horizon, when from about 10 p. m. to midnight I observed two brilliant spots of pure white light in the northwest and northeast, respectively. These spots had the outline of a candle flame and their intensity varied from that of mild moonlight to a light so strong that it was almost possible to read by it on the bridge. In the brighter intervals fascicles of rays shot from each spot to the zenith, where, from time to time both spots were united in a great arc of light intersecting the Milky Way at an angle of 20°. Stars of the higher magnitudes were distinctly recognizable through the aurora itself.

Both spots appeared to have sharply defined bases at an altitude of about 40°, sending vertical streamers toward the zenith only. No luminous phenomena were visible from the bases of the brilliant spots down to the horizon. At the same time very frequent heat lightning was observed in the west.

At 2:45 a. m. we passed the Nantucket Shoals lightship at a speed of 11 miles per hour. In the mean time—about 1 a. m.—the aurora in the northwest had disappeared and the one in the northeast had shifted slowly to about due east, where it remained visible until daybreak. The heat lightning in the west had continued uninterruptedly.

At 7:20 a. m., May 16, the ship ran into a bank of fog, whereupon the compass immediately began to oscillate and show perceptible electrical disturbances. Repeated observations showed a sudden increase in the easterly deviation amounting to about 1.5°. Accurate determinations of this increase were not practicable on account of the oscillations of the compass card, which swung 15° to 22° to either side. When the fog disappeared about 10 a. m. this magnetic disturbance disappeared also.

I believe I am not in error when I assume a causal connection between the above described phenomena.

Very respectfully,

(Signed) R. NISS, Captain.

We reprint the following observation<sup>1</sup> of the same aurora as seen from Blue Hill Observatory, Mass., in latitude 42° 13' N., longitude 71° 07' W., altitude 105 meters.

BLUE HILL OBSERVATORY, May 17, 1909.

One of the brightest auroras seen in recent years at Blue Hill Observatory was visible for several hours on the evening of May 15 last. When first observed, at 8:58 p. m., it formed three detached luminous patches, the two brightest having been near the zenith. At 9:10 p. m. the latter two merged to form one large bluish-gray mass, of unusual brightness. After that, the luminosity changed rapidly from moment to moment, while the form was altered but slightly, the whole mass moving slowly to the south and west. For about three quarters of an hour the main mass took the shape of a long-handled dipper, the bowl appearing like the head, and the handle like the tail of a huge comet, which many people thought the phenomenon to be. At 10:36 p. m. it was seen as five detached areas of light, which, after about ten minutes, joined to form an unbroken arch which reached from west to east almost entirely across the sky, the highest point passing slightly to the south of the zenith. After 11 o'clock the arch broke up into separate masses which changed in brilliancy from time to time, but gradually faded until all had disappeared by 11:30 p. m. In the two hours from 8:59 p. m. to 10:59 p. m. the mass moved as a whole about 25° toward the south and about 50° toward the west, as measured from a point near the center of the main mass which was originally about 5° to the north of the zenith. After 10 o'clock we had the unusual condition of the "northern lights" entirely to the south of a west-to-east line through the zenith. It is also worthy of note that the southern border was at all times a distinct and clean-cut line, while the northern border was everywhere indefinite, gradually dying out at about 30° to the north of the zenith. During the course of the evening the luminous area varied in width from 10° to about 35°.

The aurora was remarkable on account of its unusual position, its rapid changes in brilliancy, and its varying shape. The color was a pale bluish-gray, no iridescence having been seen at any time. Moreover, there was no suggestion of streamers or rapidly-moving iridescent patches, often referred to as "merry dancers." When the aurora was

<sup>1</sup>See Science, 1909, 30 (N.S.):57.